

The Impact of a “Physics First” course sequence on Science Learning

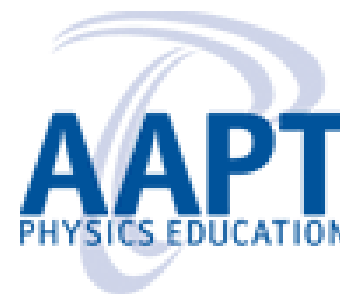


McGill-Toolen
Catholic High School
Mobile, Alabama
2005-2014



Presented at the Alabama Section of the AAPT
April 5, 2014

University of South Alabama
in Mobile Alabama

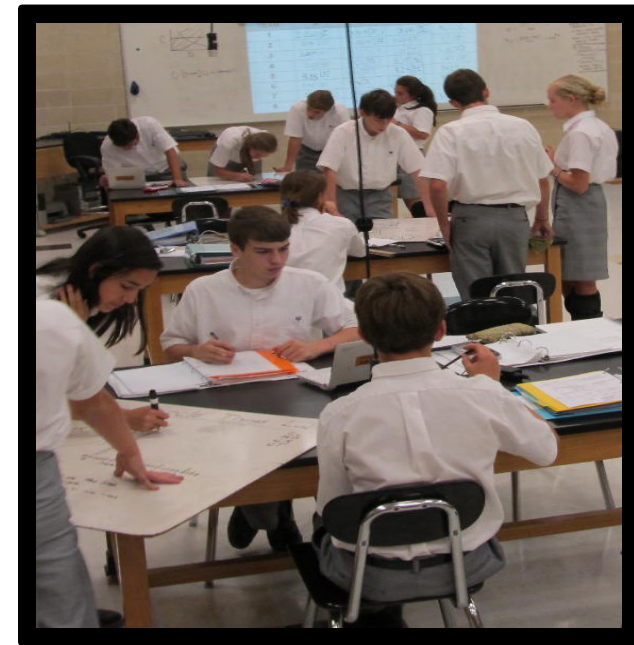


Please note that the views expressed in this presentation by me do not represent the views of McGill-Toolen Catholic High School, Archdiocese of Mobile or any part of the Universal Catholic Church.



The Possible Impact of “Physics First” course sequence on Science Learning?

First goal is to “do no harm.”
A “burn in period” of 3 to 5 years
was thought to be needed.
Experience and communication
would take advantage of the
coherent sequence of sciences.



Goals prior to implementation:

- provide **ALL STUDENTS** in the school with exposure to physics in a full year course (at an appropriate level)
- provide opportunities to actively do science in the classroom
- increase Advanced Placement Science selection
- increase Advanced Placement Science Exam qualifying scores
- provide new opportunities for student success at interscholastic science competitions

McGill-Toolen Catholic High School

established in 1896

Grades:	9-12	Enrollment:	~1170 (2012)
Minority Enrollment:	16%	Days on Roll:	180
Accreditation:	Southern Association of Colleges and Schools		
Science Requirements:	4 years of science required		



General Time Line:

- 2005:** Fund raising and planning for new science facilities
- 2006:** New Sequence discussed with principal & president.
Staff has numerous formal presentations, research & discussion.
Architect final drawings accommodate physics first needs (1-3)
- 2007:** Formal presentation on Physics First to Math staff representatives
Science department rejects "Honors only" change
Unanimously votes for change in sequence for all levels
- 2008:** Central office approval process (Archdiocese of Mobile)
Text selection process for five new electives
- 2009:** First year of transition completed at end of 2009
- 2011:** Science classes moved to new science building
- 2012:** Final year of transition completed with class of 2012
- 2013:** Year of transition completed in prior school year

Sequence prior to 2008

<u>Grade</u>	<u>Course</u>
9	Integrated Science
10	Biology
11	Chemistry
12	Science Electives:

Anatomy & Physiology,
AP Bio, AP Chem, AP Phys,
Marine Science, Organic Chemistry,
Physics (Conceptual, Regular, Honors),

New Sequence completed 2012

<u>Grade</u>	<u>Course</u>
9	Physics
10	Chemistry
11	Biology (AP Bio option)
12	Science Electives:

Anatomy & Physiology,
AP Bio, AP Chem, AP Phys, **AP Env Sci**,
Marine Science, Organic Chemistry,
Earth & Space Science,
Forensics, Genetics, Zoology



Transition Year

2008-9

2009-10

2010-11

2011-12

Unique (but temporary) Challenges

Physics I for Freshman & Seniors

Physics for Freshman & Seniors

Chemistry for Sophomores & Juniors (No Biology!)

Physics Freshman & Seniors

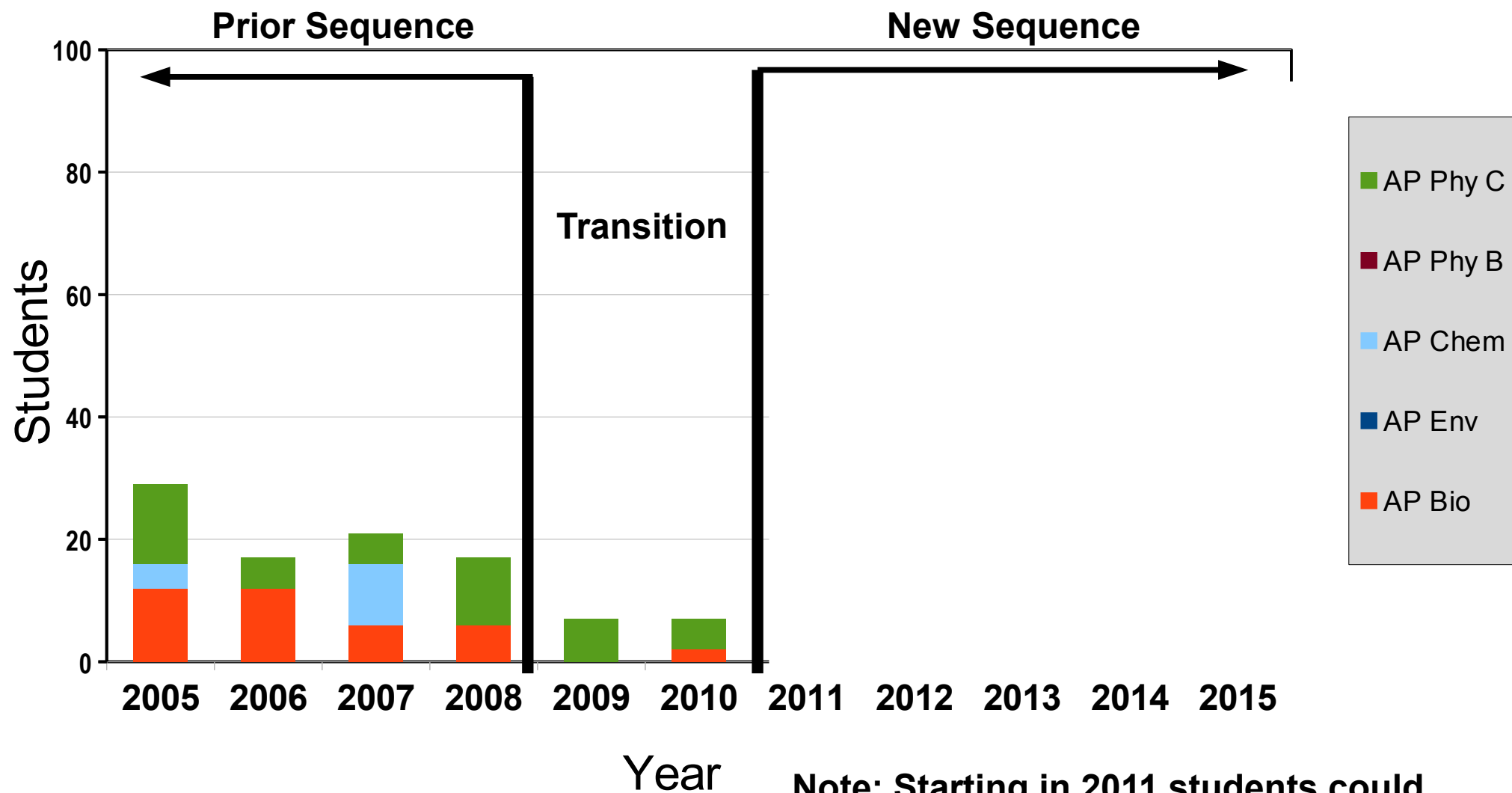
Biology for Juniors (AP Biology available to juniors)

Transition Complete



Advanced Placement Science Selection

Students signing up for AP Science Electives 2005-2014

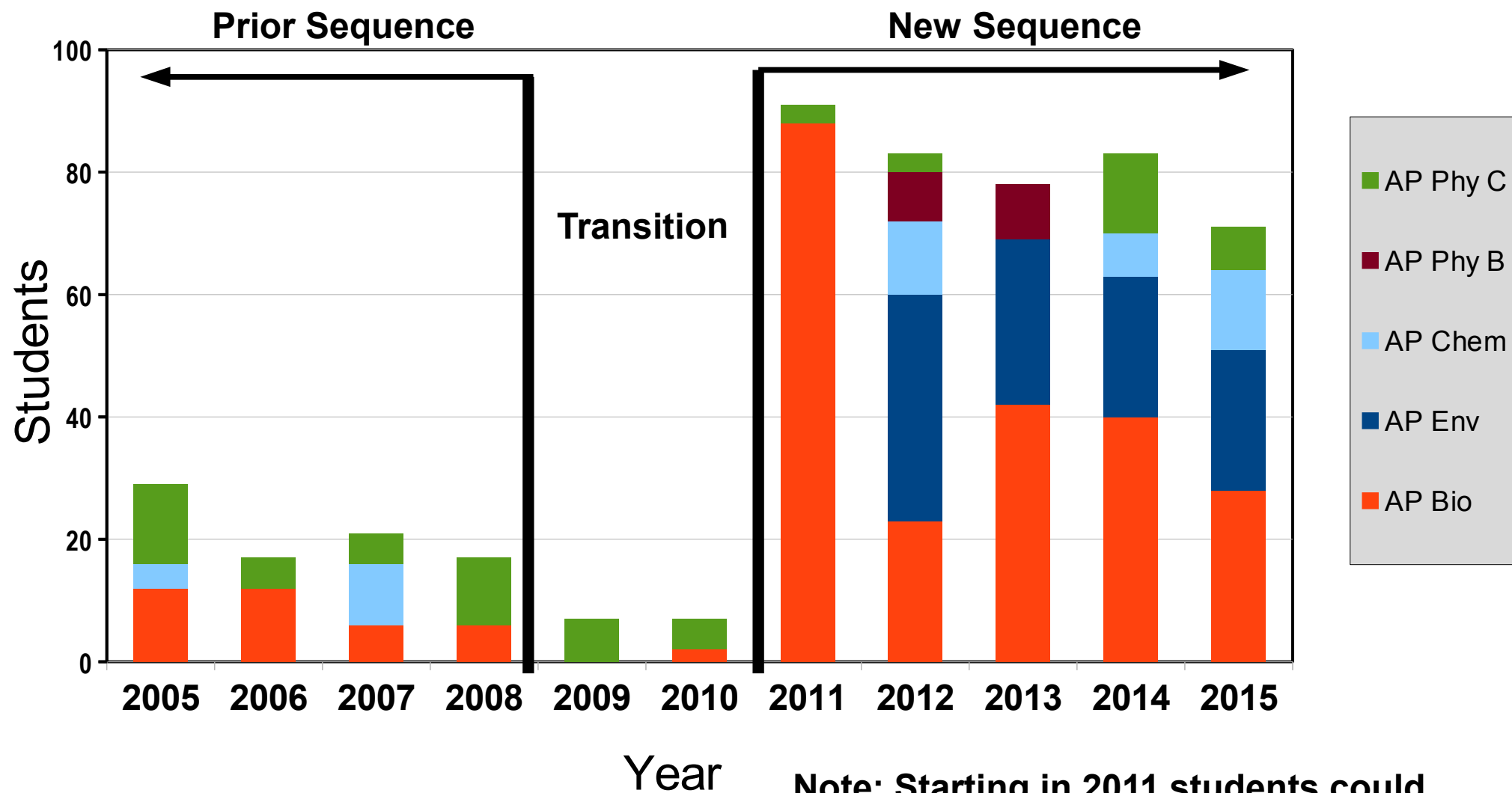


Note: Data obtained from registration in April of the year prior to the class.



Advanced Placement Science Selection

Students signing up for AP Science Electives 2005-2014



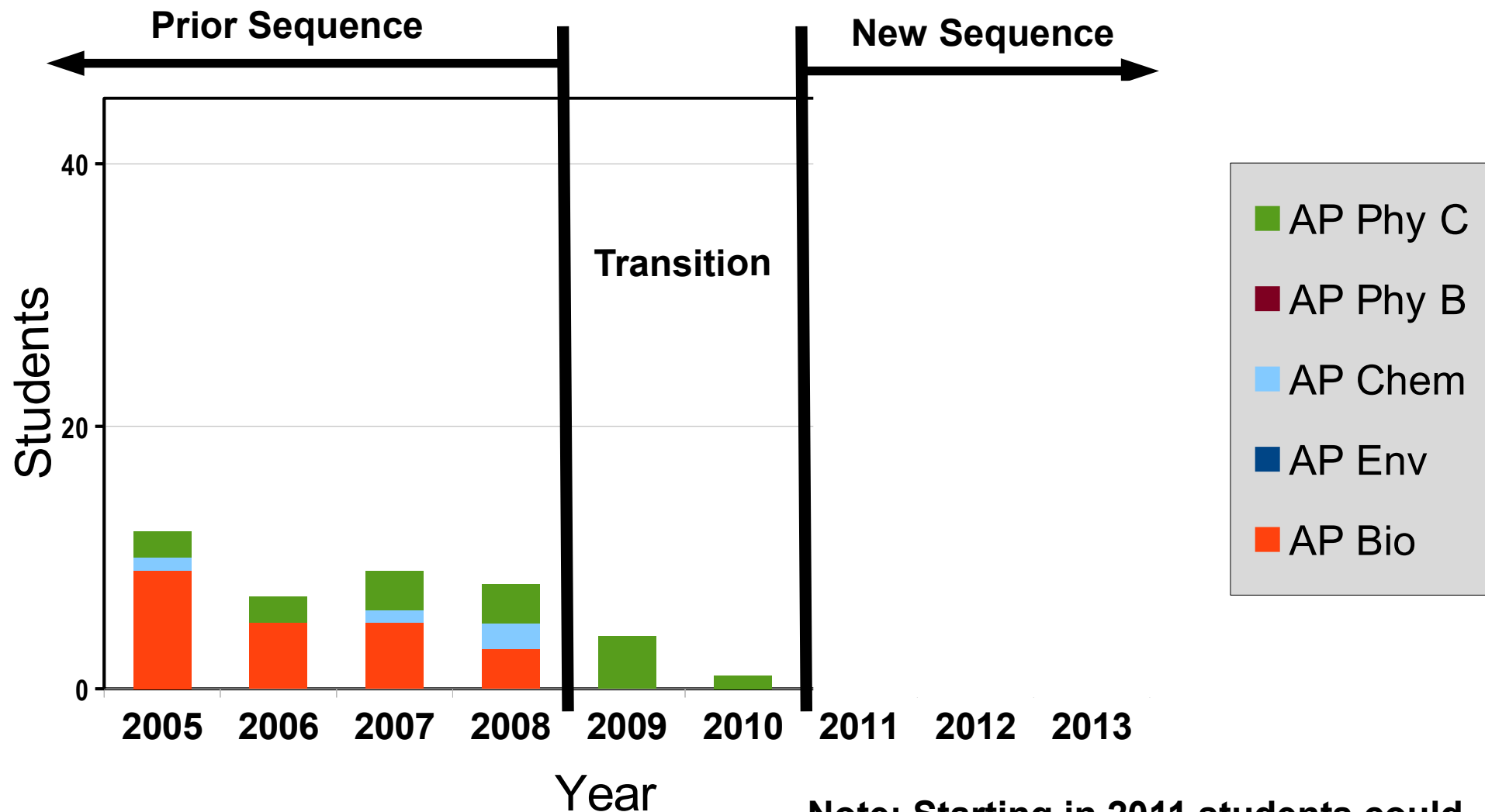
Note: Starting in 2011 students could take AP Biology in the junior year.

Note: Data obtained from registration in April of the year prior to the class.



Advanced Placement Science Qualified

Students scoring qualified or higher on AP Science Exams 2005-2012

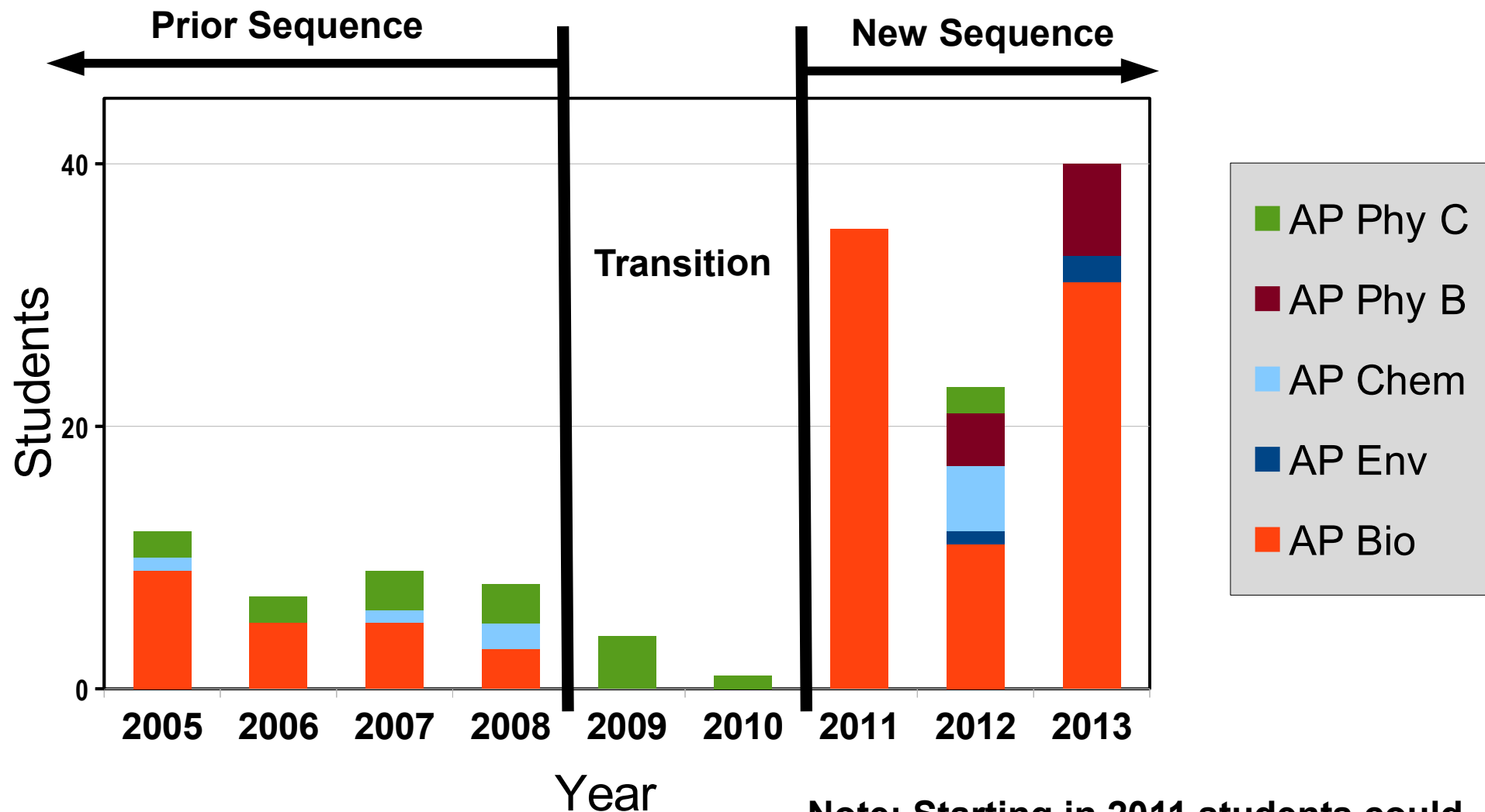


Note: Starting in 2011 students could take AP Biology in the junior year.



Advanced Placement Science Qualified

Students scoring qualified or higher on AP Science Exams 2005-2012



Note: Starting in 2011 students could take AP Biology in the junior year.

Impact on AP Science Performance?



- 1) In 2012 students took & passed AP Science exams in all Science disciplines for **1st time in school history***
- 2) Number of students electing AP Science Classes high even despite a larger number of non AP Science electives*

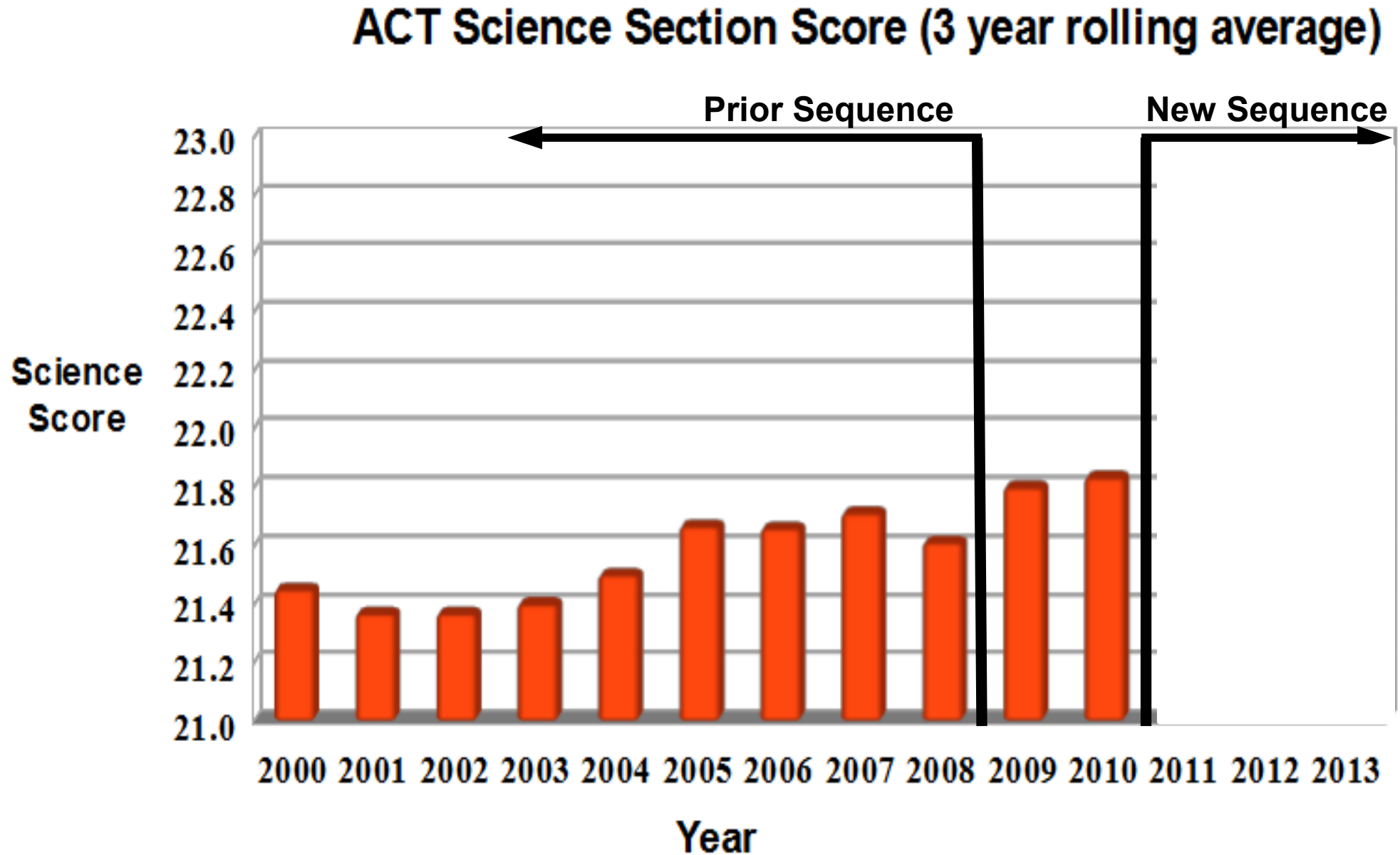
398% Increase in students taking AP Sciences
Average enrollment before and after the new science sequence

- 3) Number of students passing AP Science exams in all available science disciplines has increased since implementation of new sequence*

262% Increase in students passing AP Science Exams
average qualifying scores before & after the new science sequence

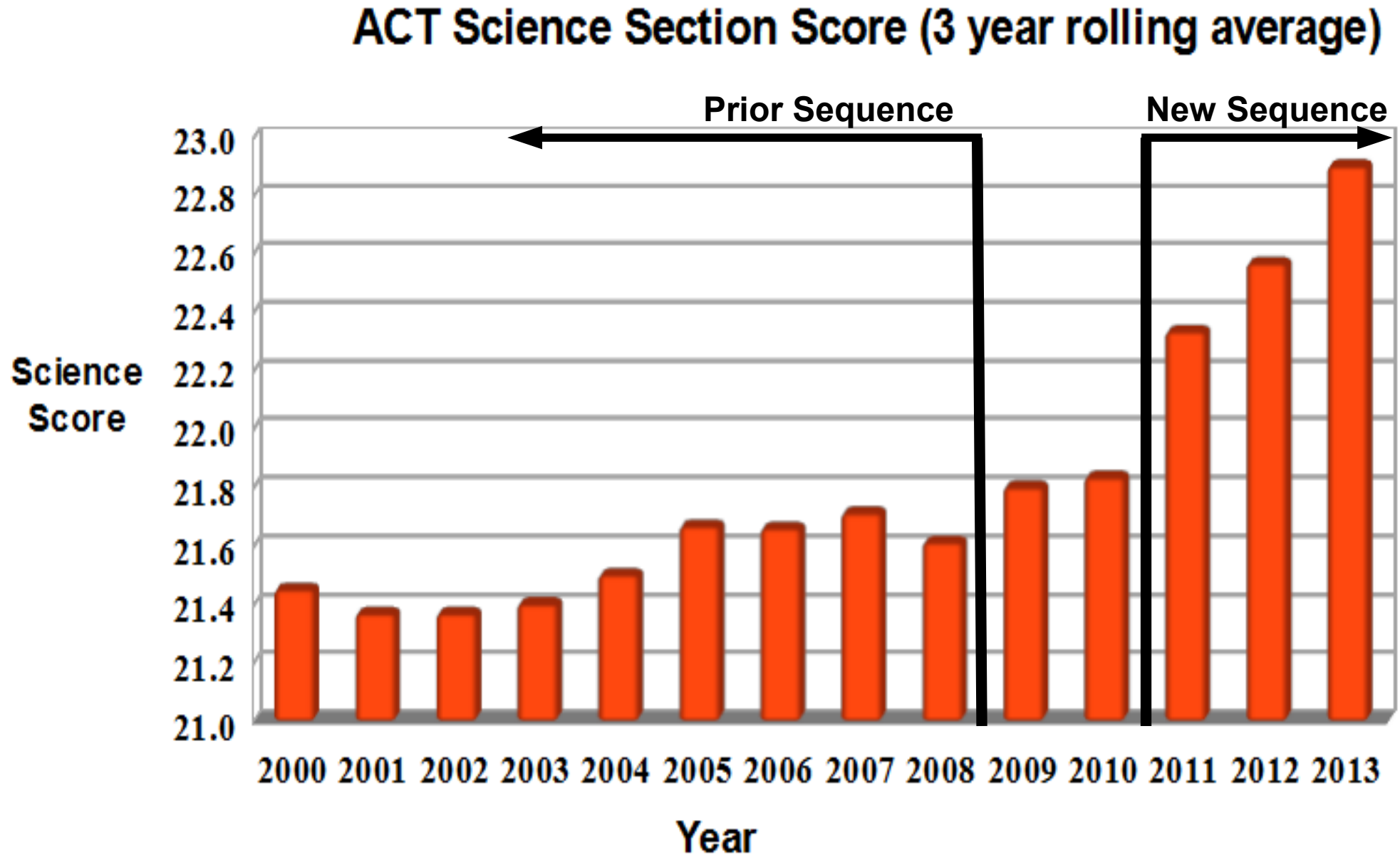
One expectation was that teachers would improve instruction over time while learning how to reduce redundancy and gaps found in an incoherent system.....

Impact of New Sequence on ACT Science Scores?



Note: Data obtained from ACT Five Year Trend Reports send to the Principal of each high school.

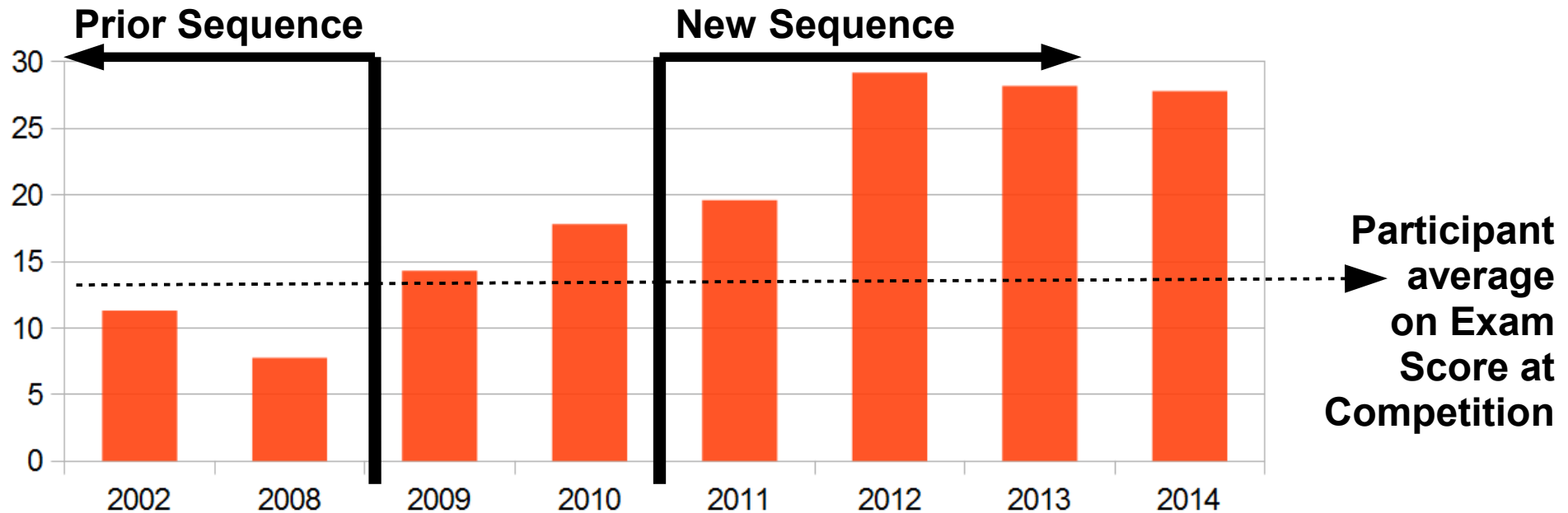
Impact of New Sequence on ACT Science Scores?



Note: Data obtained from ACT Five Year Trend Reports send to the Principal of each high school.

Impact on External Competition Performance?

McGill-Toolen Participant Performance at University of Alabama High School Physics Competition



- 1) All senior teams in 2002 & 2008*
- 2) All freshman and sophomore teams in 2009 & 2010*
- 3) There were 4 team members in 2002 & 2008 & 5 in 2009*
- 4) There were 9 team members 2010-2014*
- 5) 5 McGill-Toolen students won Individual Medals 2012-2014!
(McGill-Toolen student had never won an Individual Medal prior to 2012)*

Note: Data obtained from end of competition score reports provided to Physics Team Moderators.

Performance at Physics Competition after new sequence

2012.....2013.....2014

Matthew Heubach
Top Individual Physics Award
University of Alabama
High School
Physics Competition 2012



McGill-Toolen AP Physics Students
Win 1st Place at Competition &
Highest Recommendation of College Board



Top Individual
Honors
University of
Alabama Physics
Competition
2014
Matthew Davis
&
Collin Phillips

1st Time Ever for McGill-Toolen Catholic High School:
Matthew Davis wins Top Individual Award as a Junior!
McGill-Toolen has 3 consecutive years (2012, 13 & 14)
of Top Individual Award Winners!

McGill-Toolen A-Team

1st Place Private School Division
1st Place Over All Teams in All Divisions



Chris McDonald (freshman), Jantzen Lee (senior),
Allen Davis (senior), Kevin Kusch (senior)

Top Scores
McGill-Toolen A Team: 73 pts
1st Overall Teams

Hoover A-Team 65 pts
1st among large Public Schools

Ranburne A-Team: 58 pts
1st among Regular Schools

Miss. Math & Sci School: 53 pts
1st among Science & Math
Magnet Schools



1st Time Ever for McGill-Toolen Catholic High School:
Back to Back Team Championships (2013 & 14)
in Private Schools and Overall Teams in All Divisions
Back to Back School Physics Championships 2013 & 14

Factors that may also have influenced science program performance during this time include:



- Rearrangement of electives allowed students more opportunity for AP Sciences
- New science staff (5 new science staff hired during transition)
- Freshman Physics Teachers trained in “Modeling Physics” with majority of students taking Model Based Inquiry Physics the freshman year.
- Science staff took part in week long “Faith and Science Seminars” during the summer reviewing the origins of western science and the writings using classic readings seminar dialogue techniques
- Implementation of a “Standardized Testing Review Day” from 2011-14
- “Curriculum Mapping” effort that required classes be aligned with standards (state, college board) and then reviewed with peers (2008-2012)
- Repeated emphasis (Department Minutes) on fully using new facilities

Thank you to those who supported and empowered this change!

- President Fr. Bry Shields
- Principal Michelle Haas
- Superintendent Gwen Byrd
- Curriculum Supervisor Karen Abreo
- Dr. Hestenes, Jane Jackson ASU
- Modeling Teacher Association
- Dr. Neff Weber (USA Phys, Chair, Retired)
- Barry Walker (Briarwood Academy)
- The many unnamed Physics Colleagues who vouched for this proposal!



Numerous action studies on the implementation of Physics First are available at:
<http://home.comcast.net/~physicsfirst/site/?/page/Research%2FExperience/>